Amendments to the Claims

The following listing of the claims replaces all previous listings and versions of the claims in the application.

Listing of the Claims:

Claim 1: (Cancelled)

2. (Currently Amended) A mixing device according to claim [[1]] 46, wherein said no-slip two-phase flow velocity of said combined flow in [[a]] each of the mixing ~~orifice~~ orifices is between [[3.5]] 3.0 m/s and [[14.5]] 15 m/s during at least one operational phase of said reactor.

3. (Cancelled)

4. (Currently Amended) A mixing device according to claim [[1]] 2 , wherein said no-slip two-phase flow velocity in at least one mixing orifice, during at least one operational phase of said reactor, is between 4.0 m/s and 12.5 m/s.

5. (Currently Amended) A mixing device according to claim [[1]] 46, ~~and further comprising two sequentially arranged second mixing orifices,~~ wherein said no-slip two-phase flow velocity in [[a]] at least one mixing orifice, during at least one operational phase of said reactor is between 3.5 m/s and 10.5 m/s.

6. (Currently Amended) A mixing device according to claim [[1]] 46, wherein the mixing device has an overall slope ~~of said mixing device~~ from one side thereof to the other side thereof [[is]] of less than 20%, corresponding to an angle with the horizontal plane of maximum 11.5 degrees.

7. (Currently Amended) A mixing device according to claim [[1]] 46, wherein said flow path downstream from [[a]] at least one of the first and second mixing ~~orifice~~ orifices comprises an expanded area flow path section having such a cross-sectional area that the no-slip two-phase flow velocity in said expanded area flow path is substantially lower than the no-slip two-phase flow velocity through ~~the corresponding~~ said at least one of the mixing ~~orifice~~

orifices such that increased hold time of said flow in said expanded area flow path section is provided for effecting heat and mass transfer.

8. (Currently Amended) A mixing device according to claim 7, wherein said expanded area flow path section comprises ~~at least two~~ first and second flow channels for ~~dividing said entire combined flow into at least two separate two-phase~~ the first and second flow streams, respectively, said ~~at least two~~ flow channels having [[such]] a combined cross-sectional area such that the no-slip two-phase flow velocity of each of the ~~at least two separate~~ two-phase flow streams is substantially lower than the no-slip two-phase flow velocity through the corresponding mixing orifice, such that increased hold time in said channels is provided for effecting heat and mass transfer.

9. (Currently Amended) A mixing device according to claim 8, wherein the ~~at least two separate~~ first and second two-phase streams are of substantially the same size.

10. (Currently Amended) A mixing device according to claim 7, wherein the total cross-sectional area of said expanded area flow path section [[or]] of said channels ~~with divided flow~~ is such that the maximum no-slip two-phase flow velocity is more than approximately 25% of the no-slip two-phase flow velocity in ~~the upstream~~ said at least one of the mixing ~~orifice~~ orifices with combined flow.

11. (Currently Amended) A mixing device according to claim 7, wherein the total cross-sectional area of said expanded area flow path section is such that the minimum no-slip two-phase flow velocity is less than approximately 100% of the no slip two-phase flow velocity in ~~the upstream~~ said at least one of the mixing ~~orifice~~ orifices with combined flow.

12. (Currently Amended) A mixing device according to claim [[1]] 46, wherein said catalytic reactor is a vertical hydroprocessing reactor with a downward concurrent flow of vapor and liquid in which hydrocarbons are reacted with hydrogen-rich gas in the presence of a hydroprocessing catalyst.

Claim 13: (Cancelled)

14. (Currently Amended) A mixing device according to claim [[13]] 47, wherein the mixing device has an overall slope ~~of said mixing device~~ reckoned from at least a majority of first

points on the periphery of one of said top [[or]] and bottom [[wall]] walls to the respective points on said periphery of said one of the top [[or]] and bottom [[wall]] walls, respectively, most remote from the respective first points, that is less than 20%, corresponding to an angle with the horizontal plane of maximum 11.5 degrees.

15. (Currently Amended) A mixing device according to claim [[13]] 47, wherein said top and bottom walls are essentially planar and ~~preferably~~ mutually parallel and ~~preferably~~ also essentially horizontal.

16. (Currently Amended) A mixing device according to claim [[13]] 47, wherein said no-slip two-phase flow velocity of said combined flow in the mixing ~~orifice~~ orifices is between [[3.5]] 3.0 m/s and [[14.5]] 15 m/s during at least one operational phase of said reactor.

17. (Cancelled)

18. (Currently Amended) A mixing device according to ~~13 and~~ claim 47 ~~comprising a single second mixing orifice~~, wherein said no-slip two-phase flow velocity in [[a ]] at least one of the mixing ~~orifice~~ orifices, during at least one operational phase of said reactor, is between 4.0 m/s and 12.5 m/s.

19. (Currently Amended) A mixing device according to claim [[13]] 47 and comprising two sequentially arranged second mixing orifices, wherein said no-slip two-phase flow velocity in [[a]] at least one of the mixing ~~orifice~~ orifices, during at least one operational phase of said reactor, is between 3.5 m/s and 10.5 m/s.

20. (Currently Amended) A mixing device according to claim [[13]] 47, wherein said ~~baffle walls~~ baffles are configured such that said flow path downstream of [[a]] at least one of the first and second mixing ~~orifice~~ orifices comprises an expanded area flow path section having [[such]] a cross-sectional area such that the no-slip two-phase flow velocity in said expanded area flow path section is substantially lower than the no-slip two-phase flow velocity through ~~the corresponding~~ said at least one of the mixing ~~orifice~~ orifices such that increased hold time of said flow in said expanded area flow path section is provided for effecting heat and mass transfer.

21. (Original) A mixing device according to claim 20, wherein said expanded area flow path section comprises at least two flow channels for dividing said entire combined flow into at least two separate two-phase streams, said at least two channels having such a combined cross-sectional area that the no-slip two-phase flow velocity of each of the at least two separate two-phase streams is substantially lower than the no-slip two-phase flow velocity through the corresponding mixing orifice such that increased hold time in said channels is provided for effecting heat and mass transfer.

22. (Original) A mixing device according to claim 21, wherein said at least two separate two-phase streams are of substantially equal size.

23. (Currently Amended) A mixing device according to claim 20, wherein the total cross-sectional area of said expanded area flow path section is such that the maximum no-slip two-phase flow velocity is more than approximately 25% of the no-slip two-phase flow velocity in ~~the upstream~~ said at least one of the mixing ~~orifice~~ orifices with combined flow.

24. (Currently Amended) A mixing device according to claim 20, wherein the total cross sectional area of said expanded area flow path section is such that the minimum no-slip two-phase flow velocity is less than approximately 100% of the no-slip two-phase flow velocity in ~~the upstream~~ said at least one of the mixing ~~orifice~~ orifices with combined flow.

25. (Currently Amended) A mixing device according to claim [[13]] 47, wherein said catalytic reactor is a vertical hydroprocessing reactor with a downward concurrent flow of vapor and liquid in which hydrocarbons are reacted with hydrogen-rich gas in the presence of a hydroprocessing catalyst.

26. (Currently Amended) A catalytic reactor having an upper catalyst bed superimposed on a lower catalyst bed and provided with a mixing device according to claim [[1]] 46.

27. (Currently Amended) A catalytic reactor having an upper catalyst bed superimposed on a lower catalyst bed and provided with a mixing device according to claim [[13]] 47.

28. (Currently Amended) A catalytic reactor having an upper catalyst bed superimposed on a lower catalyst bed and provided with a mixing device according to claim 14, ~~13, wherein the overall slope of said mixing device reckoned from at least a majority of first points on the~~

~~periphery of said top or bottom wall to the respective points on said periphery of said top or bottom wall, respectively, most remote from the respective first points is less than 20% corresponding to an angle with the horizontal plane of maximum 11.5 degrees.~~

29. (Currently Amended) A reactor according to claim 28, wherein said top and bottom walls are essentially planar and ~~preferably~~ mutually parallel and also essentially horizontal.

30. (Original) A reactor according to claim 28, wherein a lateral wall extending from the periphery of said top wall to the periphery of said bottom wall conforms in shape and size to the inner surface of the exterior wall of said reactor vessel.

31. (Original) A reactor according to claim 28, wherein said lateral wall is constituted by the exterior wall of said reactor vessel.

32. (Original) A reactor according to claim 28, further comprising means for obstructing or sealing any space between said lateral wall and the exterior wall of said reactor vessel to obtain an essentially fluid-tight joint between the mixing device and said reactor vessel wall such that the entire flow of vapor and liquid is constrained to flow through said mixing device.

33. (Original) A reactor according to claim 28, wherein the cross-sectional area of the essentially horizontal mixing device in the plane perpendicular to the reactor vessel wall is between 25% and 100% of the inner cross sectional area of said reactor vessel.

34. (Currently Amended) A reactor according to claim 26, wherein flow means are provided for causing a cold quench fluid to flow into the reactor vessel ~~to cool down the process stream~~ at a point upstream <u>from</u> the first mixing orifice ~~or between two mixing orifices~~.

35. (Currently Amended) A reactor according to claim 27, wherein flow means are provided for causing a cold quench fluid to flow into the reactor vessel ~~to cool down the process stream~~ at a point upstream <u>from</u> the first mixing orifice ~~or between two mixing orifices~~.

Claims 36-45: (Canceled)

46. (New) A mixing device for use in a reactor vessel of a catalytic reactor and arranged in the reactor vessel between an upper catalyst bed and a lower catalyst bed for admixing vapor

and liquid flowing concurrently inside the reactor vessel through the catalyst beds, the mixing device comprising:

a substantially horizontal flow path defined between an inlet and an outlet;

a flow dividing structure disposed in the flow path so as to divide a combined flow of vapor and liquid through the flow path into first and second two-phase flow streams of vapor and liquid; and

at least first and second mixing orifices, the first mixing orifice disposed in the flow path upstream from the flow dividing structure, and the second mixing orifice disposed in the flow path downstream from the flow dividing structure so as to recombine the first and second flow streams, the first and second mixing orifices being arranged and configured so that substantially the entire combined flow of liquid and vapor is constrained to flow through each of the first and second mixing orifices, wherein each of the first and second mixing orifices has a flow-through area relative to the flow rate of the combined flow such that the no-slip two-phase flow velocity of the combined flow in each of the first and second mixing orifices during at least one operational phase of the reactor is sufficient for the liquid to be dispersed into the vapor and/or the vapor to be dispersed into the liquid.

47. (New) A mixing device for use in a reactor vessel of a catalytic reactor and arranged in the reactor vessel between an upper catalyst bed and a lower catalyst bed for admixing vapor and liquid flowing concurrently inside the reactor vessel through the catalyst beds, the mixing device comprising:

a top wall having a periphery and provided with at least one inlet;

a bottom wall having a periphery and provided with at least one outlet;

a substantially horizontal flow path defined between the inlet and outlet;

a lateral wall extending between the periphery of the top wall and the periphery of the bottom wall and defining an enclosed space between the top and bottom walls; and

interior baffles extending between the top and bottom walls and configured to define the flow path together with the top, bottom and lateral walls, the baffles being further configured and located between the inlet and the outlet so as to define first and second mixing orifices arranged sequentially along the flow path, the first and second mixing orifices being located and configured so as to constrain substantially the entire combined flow of liquid and vapor to flow through each of the mixing orifices, wherein each of the first and second

mixing orifices has a flow-through area relative to the flow rate of the combined flow such that the no-slip two-phase flow velocity of the combined flow in each of the mixing orifices during at least one operational phase of the reactor is sufficient for the liquid to be dispersed into the vapor and/or the vapor to be dispersed into the liquid.

48. (New) A reactor according to claim 26, wherein flow means are provided for causing a cold quench fluid to flow into the reactor vessel at a point between the first and second mixing orifices.

49. (New) A reactor according to claim 27, wherein flow means are provided for causing a cold quench fluid to flow into the reactor vessel at a point between the first and second mixing orifices.

50. (New) A mixing device according to claim 46, wherein the first mixing orifice is provided by the inlet.

51. (New) A mixing device according to claim 46, wherein the second mixing orifice is provided by the outlet.

52. (New) A mixing device according to claim 47, wherein the first mixing orifice is provided by the inlet.

53. (New) A mixing device according to claim 47, wherein the second mixing orifice is provided by the outlet.